

# EMMA Baseline Parameters (070221b)

The baseline meets the following constraints:

- The time of flight is identical at the low and high energy.
- The 15 MeV kinetic energy closed orbit crosses the line segment at the center of the long drift.
- The following three distances in the tune plane are equal:
  1. The distance from the low-energy tune to the  $\nu_x - \nu_y = 0$  resonance line, with the low-energy tune on the high- $\nu_x$ /low- $\nu_y$  side of the line.
  2. The distance from the low-energy tune to the  $\nu_x + 2\nu_y = 1$  resonance line, with the low-energy tune on the high- $\nu_x$ /high- $\nu_y$  side of the line.
  3. The distance from the high-energy tune to the  $\nu_x - 2\nu_y = 0$  resonance line, with the high-energy tune on the low- $\nu_x$ /high- $\nu_y$  side of the line.
- 0.75 times the minimum time of flight plus 0.25 times the maximum time of flight, all multiplied by 42, is 72 times the period of 1.3 GHz RF.
- The maximum fields in both quadrupoles are identical. By this I mean that if one finds a circle whose center is the center of the quadrupole and which encloses all of the beam ellipses with a normalized acceptance of 3 mm, then the maximum field on that circle is the field in question.

These constraints define the [quadrupole lengths](#) as well as the remaining four parameters (the gradients and displacements). This was used to produce a baseline lattice for an earlier run (070119a). Due to a small error in that, a corrected run was later made, but the lengths were fixed (to avoid changing the geometry), and the maximum field and 1.3 GHz synchronization constraints were released, producing the final set of parameters, which are:

	D	F
Displacement	34.048 mm	7.514 mm
Gradient	-4.704 T/m	6.695 T/m

To be able to transmit a 3 mm normalized acceptance ellipse, the following apertures will be required:

	D	F	Cavity
Minimum horizontal (chamber)	-4.280 mm	-19.000 mm	-13.680 mm
Maximum horizontal (chamber)	17.620 mm	19.509 mm	17.026 mm
Minimum horizontal (quad)	-38.328 mm	-26.514 mm	N/A
Maximum horizontal (quad)	-16.428 mm	11.995 mm	N/A
Half height	10.987 mm	5.596 mm	7.806 mm

To be synchronized to the RF at any energy, the frequency must be varied from 1.3 GHz as follows:

Minimum frequency deviation	-2198 kHz
Maximum frequency deviation	732 kHz

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